JPEG Image Compression

In this practice, the JPEG compression method is used to reduce the size of an image, while it is still desirable and clear. This method removes the high-frequency data that are not necessary. Usually, the human eye ignores large brightness variations in (non-uniform) regions with high-intensity variations.

Using the discrete cosine transform, it is possible to extract the corresponding coefficients and remove unnecessary ones. It can be done by dividing the original image to 8×8 or 16×16 blocks. Then the coefficients will be divided into quantization arrays (elementwise) which here are called Q-Matrix. The new numbers will be rounded to the nearest integer numbers. By calculating the IDCT of these coefficients, the image will take fewer size on disk. In between, the image values must be centered to zero by subtracting 128 (in this case) from the values. This step reduces the dynamic range requirements in the DCT processing stage.

The results of using Q-Matrices with different values are as follows:

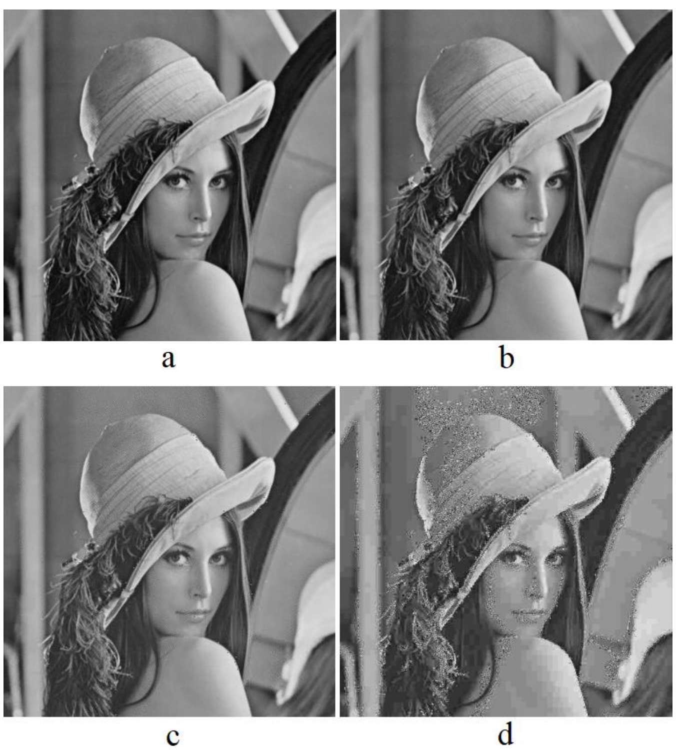

Figure 1. Applying JPEG Image Compression on Lenna image using various Q-Matrices. (a) Original Image, (b) Q90, (c) Q50, (d) Q10

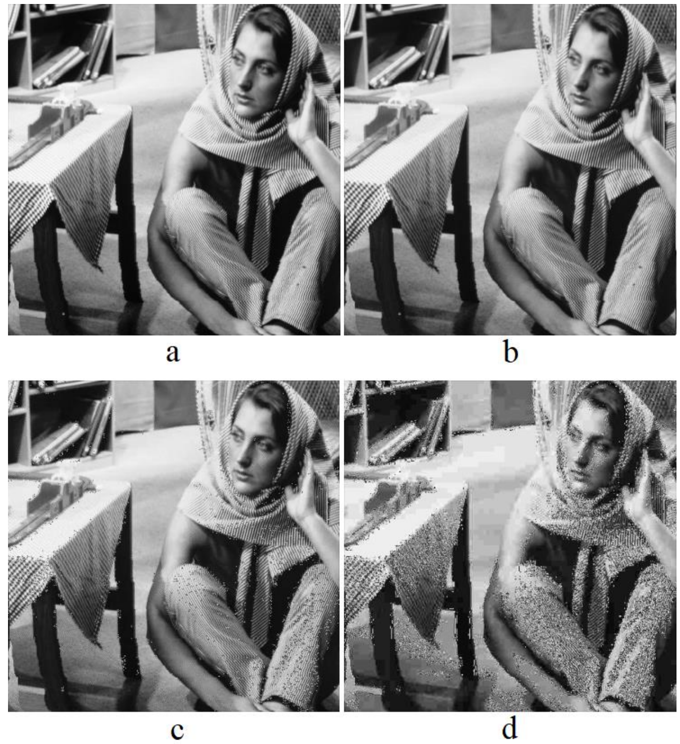

Figure 2. Applying JPEG Image Compression on Barbara image using various Q-Matrices. (a) Original Image, (b) Q90, (c) Q50, (d) Q10

The next code lines show the general part of image compression method which is written in Python:

```
for i in np.arange(int(wid/block)):
    for j in np.arange(int(hei/block)):
        sliced[:,:,i,j]=img[i*block:(i+1)*block,j*block:(j+1)*block]
for i in np.arange(int(wid/block)):
    for j in np.arange(int(hei/block)):
        dct[:,:,i,j]=np.round(cv2.dct(sliced[:,:,i,j])/Qmat)
for i in np.arange(int(wid/block)):
    for j in np.arange(int(hei/block)):
        invlist[:,:,i,j]=cv2.idct(dct[:,:,i,j]*Qmat)
for i in np.arange(int(wid/block)):
    for j in np.arange(int(hei/block)):
        img_new[i*block:(i+1)*block,j*block:(j+1)*block]=invlist[:,:,i,j]
```

The programming files of the previous CHW is attached to the present homework.